CLAIMS

What is claimed is:

1. A process for converting a hydrocarbon-containing feed gas to liquid hydrocarbon products comprising:

(a) reacting the hydrocarbon-containing gas and an oxygen-containing gas in a syngas reactor under conditions effective to produce a first syngas stream comprising primarily hydrogen and carbon monoxide with a measurable amount of oxygen;

(b) subjecting at least a portion of the first syngas stream from step (a) to an oxygen removal process under conditions effective to produce a second syngas stream wherein said second syngas stream comprises less oxygen than said first syngas stream; and

(c) reacting at least a portion of the second syngas stream of step (b) in a synthesis reactor under conditions effective to produce liquid hydrocarbon products.

2. The process of claim 1 wherein the concentration of oxygen in the second syngas stream produced in step (b) comprises less than 1000 ppm.

3. The process of claim 1 wherein the concentration of oxygen in the second syngas stream produced in step (b) comprises less than 100 ppm.

4. The process of claim 1 wherein the syngas reactor comprises a short contact time reactor.

5. The process of claim 1 wherein the oxygen-containing gas in step (a) comprises O_2.

6. The process of claim 1 wherein step (b) is carried out in a separate vessel from the syngas reactor of step (a).

7. The process according to claim 1 wherein the oxygen removal process comprises an oxygen selective adsorption.

8. The process according to claim 1 wherein the oxygen removal process comprises pressure swing adsorption.

9. The process according to claim 1 wherein the oxygen removal process comprises oxidation of Fischer-Tropsch wax.

10. The process according to claim 1 wherein the oxygen removal process comprises

functionalization of hydrocarbons.

11. The process according to claim 1 wherein the oxygen removal process comprises absorption of oxygen using a liquid medium.

12. The process according to claim 1 wherein the oxygen removal process comprises oxygen combustion.

13. The process according to claim 1 wherein the oxygen removal process comprises methane oxidation.

14. The process according to claim 1 wherein the oxygen removal process comprises hydrogen peroxide production.

15. The process according to claim 1 wherein the oxygen removal process comprises a biocatalytic reaction with oxygen.

16. The process according to claim 1 wherein the oxygen removal process comprises the use of oxygen by aerobic organisms, enzymes or combinations thereof.

17. The process according to claim 1 wherein the oxygen removal process comprises a physical or chemical sorption process.

18. The process according to claim 1 wherein the oxygen removal process comprises two or more processes selected from the group consisting of:

(a) a catalyst that will promote a reaction between oxygen and carbon monoxide, hydrogen or methane,

(b) selectively separating oxygen from the synthesis gas,

(c) oxygen selective adsorption,

(d) pressure swing adsorption,

(e) oxidation of Fischer-Tropsch wax,

(f) functionalization of hydrocarbons,

(g) absorption of oxygen using a liquid medium,

(h) methane oxidation,

(i) oxygen combustion,

(j) hydrogen peroxide production, and

(k) the use of oxygen by aerobic organisms, enzymes or combinations thereof.

19. The process of claim 1 wherein the hydrocarbon-containing feed gas in step (a) comprises natural gas or methane.

20. The process of claim 1 wherein the synthesis reactor in step (c) comprises a Fischer-Tropsch reactor.

21. The process of claim 1 wherein the synthesis reactor in step (c) comprises an alcohol synthesis reactor.

22. The process of claim 1 wherein the synthesis reactor in step (a) comprises catalytic partial oxidation.

23. The process of claim 1 wherein the oxygen in the first syngas stream comprises less than or equal to about 0.5 % (volume).

24. The process of claim 1 wherein the oxygen in the first syngas stream comprises an amount in the range of about 1000 ppm to about 5000 ppm.

25. The process of claim 1 wherein the oxygen in the first syngas stream comprises an amount in the range of about 100 ppm to about 1000 ppm.

26. The process of claim 1 wherein the oxygen in the first syngas stream comprises an amount in the range of about 100 ppm to about 5000 ppm.

27. The process of claim 1 wherein the synthesis reactor in step (c) comprises a solid catalyst.

28. The process of claim 27 wherein the solid catalyst comprises a cobalt based catalyst.

29. A process for making hydrocarbons comprising feeding a syngas stream under conversion promoting conditions to a Fischer-Tropsch reactor to form hydrocarbon products, wherein the syngas stream is made from a partial oxidation of a hydrocarbon containing feed gas stream with diatomic oxygen-containing feed gas, and further wherein the syngas stream has a diatomic oxygen concentration less than about 1000 ppm.

30. The process according to claim 29 wherein the partial oxidation comprises catalytic partial oxidation.

31. A process for making alcohols comprising feeding a syngas stream under conversion-promoting conditions to an alcohol synthesis reactor, so as to form hydrocarbon products, wherein the syngas stream is made from a partial oxidation of a hydrocarbon containing feed gas stream

with diatomic oxygen-containing feed gas, and further wherein the syngas stream has a diatomic oxygen concentration less than about 1000 ppm.

32. The process according to claim 31 wherein the partial oxidation comprises catalytic partial oxidation.

33. A process for producing liquid hydrocarbons from gaseous hydrocarbons including the step of creating synthesis gas from the gaseous hydrocarbons and catalytically converting the synthesis gas to the liquid hydrocarbons; wherein the improvement comprises reducing the concentration of oxygen in the synthesis gas prior to catalytic conversion to liquid hydrocarbons.

34. The process according to claim 33 wherein the liquid hydrocarbons comprise at least one alcohol.

35. A process for removing oxygen from a Fischer-Tropsch feedstock comprising passing the oxygen containing Fischer-Tropsch feedstock over a catalyst that will promote a reaction between oxygen and carbon monoxide contained within the Fischer-Tropsch feedstock, thereby effectively consuming the oxygen and creating a non-toxic Fischer-Tropsch feedstock.

36. A process for converting a hydrocarbon-containing feed gas to liquid hydrocarbon products comprising:

(a) reacting the hydrocarbon-containing gas and an oxygen-containing gas in a syngas reactor to produce a first syngas stream comprising primarily hydrogen and carbon monoxide with a measurable amount of oxygen;

(b) selectively separating oxygen from at least a portion of the first syngas stream of step (a) to produce a second syngas stream wherein said second syngas stream comprises less oxygen than said first syngas stream; and

(c) reacting at least a portion of the second syngas stream of step (b) in a synthesis reactor to produce liquid hydrocarbon products.

37. The process of claim 36 wherein the separation of oxygen in step (b) comprises an oxygen selective membrane.

38. The process of claim 36 wherein the concentration of oxygen in the second syngas stream produced in step (b) comprises less than 1000 ppm.

39. The process of claim 36 wherein the concentration of oxygen in the second syngas stream produced in step (b) comprises less than 100 ppm.

40. The process of claim 36 wherein the concentration of oxygen in the second syngas stream produced in step (b) comprises less than 10 ppm.

41. The process of claim 36 further comprising contacting the separated oxygen with a catalyst capable of promoting a reaction between the separated oxygen and hydrogen or carbon monoxide to produce a secondary gas stream.

42. The process of claim 37 further comprising catalytically reacting the separated oxygen with a catalyst capable of promoting a reaction between the separated oxygen and hydrogen or carbon monoxide to produce a secondary gas stream.

43. A process for converting a hydrocarbon-containing feed gas to liquid hydrocarbon products comprising:

(a) reacting the hydrocarbon-containing gas and an oxygen-containing gas in a syngas reactor under conditions effective to produce a first syngas stream comprising primarily hydrogen and carbon monoxide with a measurable amount of oxygen;

(b) contacting at least a portion of the first syngas stream in step (a) with an oxygen removing adsorbent under conditions effective to produce a second syngas stream wherein said second syngas stream comprises less oxygen than said first syngas stream; and

(c) reacting at least a portion of the second syngas stream of step (b) in a synthesis reactor under conditions effective to produce liquid hydrocarbon products.

44. The process of claim 43 wherein the oxygen removing adsorbent comprises a catalytic adsorbent bed having a catalytic metal and support.

45. The process of claim 44 wherein the catalytic metal is selected from the group consisting of Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Nb, Mo and mixtures thereof.

46. The process of claim 44 wherein the support is selected from the group consisting of alumina, silica, titania, magnesia, zirconia, silicon carbide, active carbon and mixtures thereof.

47. The process of claim 44 wherein the catalytic adsorbent bed is located within a separate

housing, wherein the first syngas stream is introduced into the housing and passes through the catalytic adsorbent bed under conditions effective to produce said second syngas stream.

48. The process of claim 44 further comprising a plurality of catalytic adsorbent beds each within a separate housing, wherein the first syngas stream can be selectively passed through any particular catalytic adsorbent bed containing housing or any combination of two or more of said catalytic adsorbent bed containing housings.

49. The process of 43 wherein the concentration of oxygen in the second syngas stream produced in step (b) comprises less than 1000 ppm.

50. The process of claim 43 wherein the concentration of oxygen in the second syngas stream produced in step (b) comprises less than 100 ppm.

51. The process of claim 43 wherein the concentration of oxygen in the second syngas stream produced in step (b) comprises less than 10 ppm.

52. A process for converting a hydrocarbon-containing feed gas to liquid hydrocarbon products comprising:

(a) reacting the hydrocarbon-containing gas and an oxygen-containing gas in a syngas reactor under conditions effective to produce a first syngas stream comprising primarily hydrogen and carbon monoxide with a measurable amount of oxygen;

(b) contacting at least a portion of the first syngas stream in step (a) with an oxygen removing absorbent under conditions effective to produce a second syngas stream wherein said second syngas stream comprises less oxygen than said first syngas stream; and

(c) reacting at least a portion of the second syngas stream of step (b) in a synthesis reactor under conditions effective to produce liquid hydrocarbon products.

53. The process of claim 52 wherein the liquid absorbent comprises aldehydes.

54. The process of claim 52 wherein the liquid absorbent comprises ascorbic acid.

55. A process for converting a hydrocarbon-containing feed gas to liquid hydrocarbon products comprising:

(a) reacting the hydrocarbon-containing gas and an oxygen-containing gas in a syngas

reactor under conditions effective to produce a first syngas stream comprising primarily hydrogen and carbon monoxide with a measurable amount of oxygen;

(b) passing at least a portion of the first syngas stream in step (a) over a catalyst that promotes a reaction between the oxygen and hydrocarbons to produce a second syngas stream wherein said second syngas stream comprises less oxygen than the first syngas stream and more oxygenates; and

(c) reacting at least a portion of the second syngas stream of step (b) in a synthesis reactor under conditions effective to produce liquid hydrocarbon products.

56. The process of claim 55 wherein the catalyst comprises a Group VIII metal.

57. The process of claim 55 wherein the catalyst comprises copper.

58. The process of claim 55 wherein the catalyst comprises iron.

59. A process for converting a hydrocarbon-containing feed gas to liquid hydrocarbon products comprising:

(a) reacting the hydrocarbon-containing gas and an oxygen-containing gas in a syngas reactor under conditions effective to produce a first syngas stream comprising primarily hydrogen and carbon monoxide with a measurable amount of oxygen;

(b) contacting at least a portion of the first syngas stream produced in step (a) with a biological oxygen removal means under conditions effective to reduce the concentration of oxygen in said first syngas stream; and

(c) reacting at least a portion of the second syngas stream of step (b) in a synthesis reactor under conditions effective to produce liquid hydrocarbon products.

60. The process of claim 58 wherein the biological oxygen removal means comprises aerobic organisms.

61. The process of claim 60 wherein the oxygen is reduced in step (b) via respiration of said aerobic organisms.

62. The process of claim 58 wherein the oxygen is reduced in step (b) via respiration of said aerobic organisms.

63. The process of claim 58 wherein the oxygen is reduced in step (b) via metabolic oxidation.

64. The process of claim 58 wherein the biological oxygen removal means comprises enzymes.

65. The process of claim 64 wherein the device selected comprises either aerobic organisms, enzymes or combinations thereof.

66. The process of claim 58 wherein the biological oxygen removal means comprises one or more device selected from the group of bio-filter, bio-scrubber, bio-trickling filter, bio-reactor.

67. The process of claim 58 wherein the biological oxygen removal means comprises aerobic organisms and enzymes.